ORGANIC GEOCHEMISTRY OF PASO DIABLO COALS (MARCELINA FM., PALEOCENE), VENEZUELA

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ABSTRACT

Six representative samples from different coal seams within the sequence of the *Marcelina* Formation (Paleocene) were subject to an organic geochemical study. The aim of the study is the establishment of the physicochemical environment conditions, the maturity level reached by the organic matter, and the variations within the log. Obtained results allowed classifying coals as high-bituminous type A, according with ASTM rules (1990), with low sulfur, moisture and ash, and very high in volatile matter content. Studied coals were derived from terrestrial organic matter, with negligible marine influence, settled in a continental environment, with minor facies changes, under strong dysoxic conditions (high Eh) and low salinity. Maturity of coals is associated with the beginning of oil window, in the first path of catagenesis of organic matter.

INTRODUCTION

Important coal fields are distributed along the Venezuelan territory, in four coal basins, representing about 693 million metric tons (MMT), being the main fields within the coal basin of Perijá, followed by the Táchira-Tarra (Escobar and Martínez, 1993).

From a geological view point, the coal-bearing Marcelina Formation represents a progradational deltaic unit, in transitional lower contact with shallow calcareous marine sediments of the Guasare Formation. In the area of Paso Diablo mine, the main open-pit coal mine, the Marcelina Formation is conformably overlain by the Misoa Formation, a thick package of lower Eocene sandstones of deltaic and shoreface origin. These Palaeogene units conformably overlie stable passive margin sediments that were deposited during the maximum worldwide Cretaceous transgression. The subsidence was similar to peat accumulation, with the formation of thick coal seams, with a high lateral continuity, very low in sulphur and inorganic impurities (Bailey, 1981). However, little work has published related with the geochemical studies on these coals.

Organic Geochemistry is an useful tool in the establishment of the type of organic matter, physicochemical depositional conditions and maturity; among the advantages, this discipline is independent of changes in the sedimentological patterns and field relationships (Moreno, 1990; Escobar and Martínez, 1993).

The purpose of this work is the organic geochemical study of Paso Diablo coals, with the aim of to establish their ASTM classification, depositional conditions and thermal maturity variations.

EXPERIMENTAL PROCEDURE

Six channel samples from the Paso Diablo coal mine were collected, according to the ASTM D4596 practice (ASTM, 2005). Figure 1 illustrates a sketch with the experimental procedure employed in the studied simples. Saturates and aromatics fractions were studied in an Agilent 5973N GC-MS equipment, with a 30 m long HP-5 capillary column.

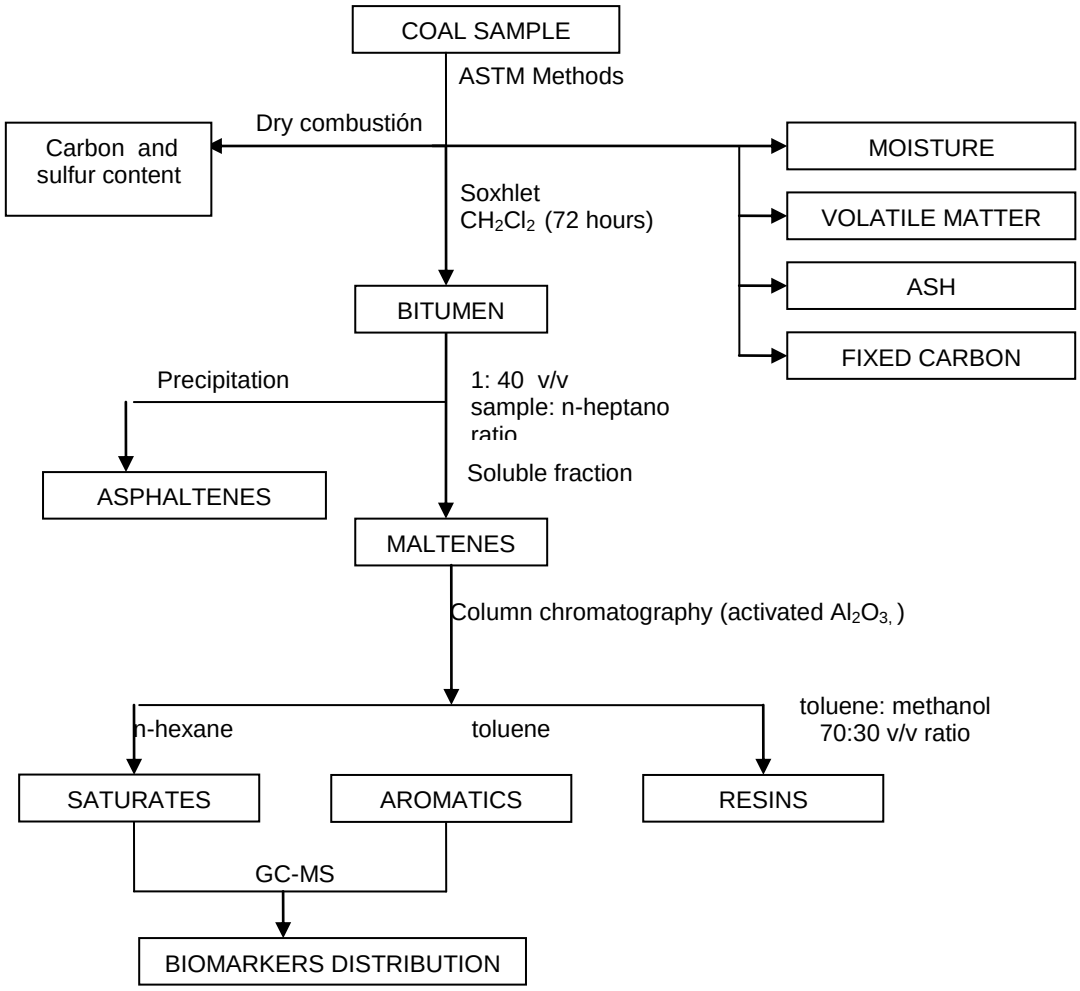

FIGURE 1.- Experimental procedure.

RESULTS AND DISCUSSION

Proximate analyses reveal (moisture 0.89-2.91%; ash 0.23-2.71%; volatile matter 37.0-45.3%, fixed carbon 52.6-58.2%) the high quality of Paso Diablo coals, and indicates their

excellent suitability as a thermal fuel resource. Calorific value averages 33.66 MJ/kg, placing the coal samples in the type A high volatile bituminous rank (HVBA). Low sulfur (<0.8 %) and ash (<3%) are suggesting peat development in raised (ombrogenous) mires (Cecil et al., 1985; Hackley and Martínez, 2006), with negligible marine influence; nevertheless, towards the top of the sequence, the marine input was slightly increased.

Distribution and content of specific biomarkers suggest that the parental organic matter was from terrestrial input, without important contribution of marine organic matter, as revealed by the high molecular weight, unimodal n-alkane distribution and absence of tricyclic terpanes, as C23-3.

TABLE 1.- Main relationships of used biomarkers.

Sample	Pri/Phy	C.P.I	Ts/ Ts+Tm	βαMor/ αβHop	MPI_1	%Rc	% Ro[1]	DMNI	TAI/TAI+TAII
ZG-015	6.3	1.3	0.18	0.3	0.6	0.77	n.d	1.2	n.d
ZG-013	11.2	1.4	0.05	0.3	0.4	0.65	0.67	1.3	0.4
ZG-010	12.4	1.6	0.08	0.3	0.4	0.61	0.71	1.9	0.8
ZG-009	6.9	1.3	0.04	0.2	0.6	0.73	0.70	1.5	0.7
ZG-001	14.5	1.6	0.07	0.3	0.6	0.78	0.72	2.4	0.7
ZG-017	16.8	1.7	0.04	0.2	0.9	0.91	0.78	2.2	0.9

High values of the pristane-phytane ratios (Pri/Phy > 4 indicate the strong dysoxic conditions in the mires; in the other hand. absence of gammacerane confirms the peat deposition on fresh, continental waters.

Derived parameters from maturity-sensitive biomarkers (e.g. odd-even n-alkanes, biological vs. geological enantiomeric distribution, βαMoretane/αβHopane distribution, phenanthrenes distribution) are consistent with the rank classification and an immature organic matter. The maturity degree is related with a calculated vitrinite reflectance of 0.6-0.7, at the beginning of the oil window.

CONCLUSIONS

High-volatile bituminous coals (HVBA) from Marcelina Fm. at Paso Diablo coal mine are of high quality and excellent as thermal fuel, with low sulphur and ash, suggesting raised mires conditions in a depositional environment not influenced by the sea. A slightly marine influence is increasing upward in the section.

The biomarkers content and distribution reveals an eminently terrestrial-type organic matter, with a thermal maturity at the beginning of the oil window.

ACKNOWLEDGEMENTS

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